50X1-HUM

FENIKS-M EQUIPMENT

OPERATING INSTRUCTIONS

ЛЖ1.106.205 И

SECRET

ABBREVIATIONS USED ON LABELS
IN FENIKS-M EQUIPMENT

Abbreviations	Descriptions in full	Translation into Russian
OPERAT.	OPERATION	РАБОТА
CALIBR.	CALIBRATION	КАЛИБРОВКА
STABIL.	STABILIZATION	СТАБИЛИЗАЦИЯ
CM	COMPENSATOR	КМ
AA	AUDIO AMPLIFIER	ЗУ
SHA	SUPERHETERODYNE	СРУ
TCA	TWO-CHANNEL AMPLIFIER	ДВУ
CS	CONTROL SUBUNIT	ПУ
TAT	TARGET AUTOMATIC TRACKING	АСЦ
T	EARPHONES	Т
ED	Electrodynamic	ЭЛЕКТРОДИНАМИЧЕСКИЙ
EM	Electromagnetic	ЭЛЕКТРОМАГНИТНЫЙ
AMPL-1	AMPLIFIER SUBUNIT	УС1
FOCUS	FOCUSSING	ФОКУС
LM	LEVEL METER	ИУ
RB to TD	RELATIVE BEARING TO TORPEDO DIRECTOR	КУ в ТАС
R and RB to TD	RANGE AND RELATIVE BEARING TO TORPEDO DIRECTOR	Д и КУ в ТАС
BRIGHT	BRIGHTNESS	ЯРКОСТЬ
CONST.	CONSTANT	ПОСТ.
U-2	UNIT 2	ПР-2
U-1-S	UNIT 1, side	ПР-1Б
U-1-C	UNIT 1, central	ПР-1Ц

SECRET

CONTENTS

CAUTION

The direction listening equipment uses high D.C. and A.C. voltages which are dangerous to life.

Therefore, in operating and repairing the equipment it is necessary to observe the necessary safety precautions. It is absolutely forbidden to replace fuses, to repair and inspect the subunits, to open the lids or withdraw the subunits when the equipment is energized. Before replacing a blown fuse, it is necessary to determine the cause of the trouble and eliminate it.

It is prohibited to employ non-standard fuses or those rated for the currents different from the values indicated in the Diagrams.

Before switching on the equipment see that all the lids and subunits would be set in places and reliably secured.

It is permissible to open various subunits before switching on the equipment only for checking valve parameters. The AUTOMATIC TARGET TRACKING - CONSTANT SPEED (АСЦ - ПОСТОЯННАЯ СКОРОСТЬ) toggle switch, ref. No.58 (see Diagram ДК2.076.000 Сх3), should be always set to position AUTOMATIC TARGET TRACKING (АСЦ). The toggle switch is set to CONSTANT SPEED (ПОСТОЯННАЯ СКОРОСТЬ) only in case of reading off the directivity pattern of the equipment when recording.

Before starting operation, it is necessary to get acquainted in details with all diagrams of the subunits and units, to learn and remember the circuits which are dangerous to life.

When replacing the cathode-ray tube it is necessary to protect the face and eyes against glass which may accidentally hurt them.

Chapter I

CONNECTION AND DISCONNECTION OF THE EQUIPMENT

1. PREPARATION FOR CONNECTION

Before connecting the equipment make sure that:

(a) switches: UNIT 2 (ПР2), OFF (ВЫКЛ), ON (ВКЛ) on the distribution board (unit 21), AUTOMATIC TARGET TRACKING (АСЦ) and MAINS (СЕТЬ) on the front panel of unit 4 are in OFF (ВЫКЛ);

(b) mode switch CHECK - OPERATION - CALIBRATION (КОНТРОЛЬ - РАБОТА - КАЛИБРОВКА) is set to position OPERATION (РАБОТА);

(c) check the fuses in unit 21 for presence, serviceability and correspondence to the diagram;

(d) check all the switches of the units for proper operation (all switches should operate without jamming and be reliably locked).

2. CONNECTION OF THE EQUIPMENT

Set the OFF - ON (ВЫКЛ - ВКЛ) switch to ON (ВКЛ). In this case the pilot lamps, ref. Nos 13, 14, 27, 28, installed in unit 21 (distribution board) should be lighted up. Simultaneously the pilot lamps installed in units 20, 8, 8A, 20A should be lighted as well.

(a) After the spot has appeared on the bearing deflection indicator screen operate knobs BRIGHTNESS (ЯРКОСТЬ), FOCUSING (ФОКУСИРОВКА), "⟷", "↕" to obtain the necessary brightness, focus and bring the spot to the tube centre.

(b) Set the CHECK - OPERATION - CALIBRATION (КОНТРОЛЬ - РАБОТА - КАЛИБРОВКА) switch to position CALIBRATION (КАЛИБРОВКА). The image on the screen should be a trace inclined at an angle of 45°. If necessary, calibrate the equipment in compliance with the present Instructions, Item 9f, Subitem I.

(c) Set the CHECK - OPERATION - CALIBRATION (КОНТРОЛЬ - РАБОТА - КАЛИБРОВКА) switch to position OPERATION (РАБОТА).

(d) Depress and rotate the aligning knob (ref. No.12, see ЛК2.702.000 Сх3) to set the relative bearing scale by the gyrocompass follower.

(e) Set the MAINS (СЕТЬ) switch on the front panel to position MAINS (СЕТЬ). In this case the pilot lamp MAINS (СЕТЬ) should be lighted on the control panel. The equipment is ready for operation.

(f) If, when the target is detected, a command is given to switch on the automatic target tracking mode, when lamps RB to T.D. (КУ в ТАС) or R and RB to T.D. (Д и КУ в ТАС) are lighted set the AUTOMATIC TARGET TRACKING (АСЦ) switch on the front panel to position AUTOMATIC TARGET TRACKING (АСЦ).

3. DISCONNECTION OF THE EQUIPMENT

To disconnect the AUTOMATIC TARGET TRACKING (ACU) channel it is necessary to do the following:

1. Set the AUTOMATIC TARGET TRACKING (ACU) switch on the control panel front to position OFF.
2. Set the MAINS (CETb) switch on the control panel to OFF (BMKU).
3. Set the OFF - ON (BMKU - BKU) switch on the distribution board (unit 21) to position OFF (BMKU), the neon lamps on the distribution board should go out.

ChapterII

COMBAT SERVICING OF THE EQUIPMENT

All the controls of the equipment are mounted on the control panel (unit 4).

Direction finding can be performed via video channel, audio channel and in the automatic target tracking mode.

4. PHASE METHOD OF DIRECTION FINDING

(a) Switches BANDS I, II (ДИАПАЗОНЫ I, II) and AMPLIFICATION I - II (УСИЛЕНИЕ I - II)of the two-channel amplifier are set to the necessary positions depending upon particular conditions under which the direction finding is carried out.

Note: When shifting switch BANDS I, II (ДИАПАЗОНЫ I, II) an error is introduced into the bearing; the error may constitute 20'-30'. Therefore, when sending data to T.D. system it is not recommended to pass from one band to the other.

(b) The direction to the target is determined by aligning the bright trace with the vertical line on the bearing deflection indicator screen rotating for the purpose the handwheel. The compensator pointer will indicate the direction towards the target (relative bearing) on the fixed scale.

5. MAXIMUM METHOD OF DIRECTION FINDING WITH STRAIGHT AMPLIFICATION

(a) Set the SUPERHETERODYNE AMPLIFIER - AUDIO AMPLIFIER (СПУ - ЗУ) switch to position AUDIO AMPLIFIER (ЗУ).

(b) The loudspeaker switch should be set to position ON (ВКЛЮЧЕНО) and when the earphones connected to jacks ЗМ are used, set the above switch to OFF (ВЫКЛЮЧЕНО). Jacks ЗП are used to connect the test devices while measuring the output parameters of the equipment.

(c) The volume control engraved MORE (ГРОМЧЕ) should be set at the sound operator's discretion to the position in which the noise volume is quite sufficient.

Having detected a maximum volume of sound in some direction quickly turn the handwheel to the right and to the left so that the drop in the sound reproduced in the earphones or by the loudspeaker would be the same when the handwheel is shifted to the right and to the left. Thus, the sound operator "brackets" the detected object (ship); the direction to the target lies in the middle of the "bracket". After the ship has been detected and taken the bearing on, it should be always kept [illegible].

Do not pass [illegible] the scale without necessity; since it is far more difficult [illegible] than to follow it constantly.

Continuous tracking of the target considerably increases the range and accuracy in direction finding. Do not use high amplification after the target has been detected since this will be fatiguous to the ear and affect the accuracy of direction finding. The amplification should be adjusted so that the noise could be distinctly heard but should not be excessively loud. It should be noted that a well-trained sound operator can determine not only the direction to the noise-generating ship but also the type of the ship by the timbre of the sound peculiar only to the given type of ships.

6. MAXIMUM METHOD OF DIRECTION FINDING WITH SUPERHETERODYNE AMPLIFICATION

(a) Set the SUPERHETERODYNE AMPLIFIER - AUDIO AMPLIFIER (СГУ - ЗУ) switch to position SUPERHETERODYNE AMPLIFIER (СГУ).

(b) The loudspeaker switch and volume control MORE (ГРОМЧЕ) are set at the operator's discretion.

(c) Operate knob TUNING (НАСТРОЙКА) to select the operating range depending on the conditions.

(d) All further operations of the sound operator are exactly the same as in the case of maximum method of direction finding with straight amplification.

7. OPERATION OF THE EQUIPMENT IN THE AUTOMATIC TARGET TRACKING MODE

After the bearing has been taken on the target manually, by the commander's order or when the RB to T.D. (КУ в ТАС) or R and RB to T.D. (Д и КУ в ТАС) white lamps are lighted the equipment is connected in the automatic target tracking mode. Check for correct operation is performed by watching the trace on the bearing deflection indicator screen or by the indicator with the scale of 60' and by the null indicator.

The trace on the bearing deflection indicator screen should be vertical, the null indicator pointer should read zero, and the pointer of the portable indicator - minutes.

When the R and RB to T.D. (Д и КУ в ТАС) white lamp is lighted up at the moment of transmitting through the earphones the range to the target which is determined with the aid of the equipment, the MEASUREMENT (ЗАМЕР) push-button should be depressed and released. In this case the DO NOT ROTATE HANDWHEEL (НЕ ВРАЩАТЬ) red pilot lamp is lighted up. Do not start rotating the handwheel until the red pilot lamp has gone out.

If automatic tracking of the target becomes impossible because of the fact that the target has gone out of the sensitivity angle, disconnect the AUTOMATIC TARGET TRACKING switch, restore the contact manually and connect the above switch again.

Chapter III

MAINTENANCE OF THE EQUIPMENT

The reliable and troublefree operation can be ensured under condition of a thorough care of the equipment and an exact observance of the present Instructions. Improper care of some units affects their operation and operation of the entire equipment.

To avoid unwanted breakdown of the equipment which may happen owing to failure of the valves, it is necessary to register the number of valve operating hours in the ship's Log Book using for the purpose the clock available on the distribution board (unit 21). With this in mind, check the valves on the valve tester upon expiration of their life guaranteed by the Manufacturer.

8. CURRENT MAINTENANCE

Current maintenance is one of the conditions which are necessary to ensure a troublefree operation of the equipment. Measures on maintenance of the equipment are divided into daily, weekly, and monthly inspections.

D a i l y I n s p e c t i o n

1. Make an external examination of the equipment units.

2. Check the equipment for proper operation for which purpose proceed as follows:

(a) switch on the equipment as described in the present Instructions, Chapter I, Items 2a - 2e;

(b) set toggle switch UNIT 2 (ПР2) on the distribution board to position UNIT 2 (ПР2), the pilot lamp in the noise generator should light up;

(c) rotate the compensator handwheel to take the bearing on the check projector;

(d) switch on the AUTOMATIC TARGET TRACKING channel (АСЦ) and check balancing as described in the present Instructions, Item g, Subitem 1;

(e) check the automatic target tracking system for proper operation.

Operation of the automatic target tracking system should be checked using the check projector or a stationary target. Rotate the compensator handwheel to bring the bright trace on the indicator to the vertical position. Has the target been bracketed, rotate the handwheel evenly in either direction at a speed of 1 revolution per 5 seconds maximum.

When the handwheel is stopped, the bright trace on the indicator should reoccupy its vertical position;

(f) wipe the exterior of the equipment units.

Note: When the noise generator with the check projector is unserviceable or when a command is given not to switch the noise generator, use an external noise source.

Weekly Inspection

1. Check electrical insulation of the circuits of equipment units following the technique stated in Item 9a. If the insulation drops below rated value, use a lamp with the reflector to dry the appropriate unit. In performing drying procedure do not bring the lamp too close to the unit to avoid causing any harm to the internal wiring insulation.

2. Remove dust from the units.

3. Clean the commutator and switching device in the compensator subunit KM of unit 4 every 48 hours, for which purpose do as follows:

(a) wash slip rings 0 - 3 and contact cords in the compensator subunit KM with rectified alcohol; this done, apply petrolatum to the slip rings;

(b) wash the compensator commutator with rectified alcohol and apply non-acid petrolatum (SPTSA set, FENIES M-3) to its bars.

Apply grease with the help of a cotton pad moistened in petrolatum and squeezed out. This done, check the insulation of conductors running from terminal 4 of the plate, ref. No.193 (amplifier UC1 subunit) in unit 4, and the resistance between the bars as described in Item 9e.

Monthly Inspection

1. Check the receivers and preamplifier respective stages for operation following the technique stated in Item 9d.

2. Check the control subunit following the technique described in the present Instructions, Item 9g, Subitems 1 - 4.

3. Check the electric elements for condition, see that the wiring and solderings are intact.

4. Examine the projecting spindles of the selsyns, the shafts and rubbing parts of unit 4 (compensator subunit KM), carefully wipe dirt with the aid of clean cloth slightly moistened in pure aviation gasoline and after the traces of gasoline have evaporated, wipe the spindles and rubbing parts with a clean cloth.

5. Apply grease as described below:

(a) TsIM-54 lubricant, to the closed ball bearings in unit 4 (compensator subunit KM) and to the projecting spindles of the selsyns;

(b) OKB-122-16 lubricant, to all worm and toothed gears in unit 4 (compensator subunit KM) and to the ball bearings.

6. Complete replacement of lubricant should be performed during repairs and at least once a year. Lubrication of closed ball bearings should be done at the workshops of the fleet.

7. Check the valves of units 8 and 8A for noise following the technique described in the present Instructions, Item 9c.

9. INSTRUMENT CHECK

The instrument check is performed with the aim to have an idea of necessity to adjust or to repair certain units.

A complete instrument check is performed at the base when necessary, minimum once a year.

(a) CHECKING ELECTRICAL INSULANCE OF THE UNITS

Measurements are taken with the aid of a megger. The EARTH lead of the megger is taken to the ground busbar and the LINE lead is alternately taken to the terminals.

General directions

1. Check the megger for operation. The megger should read "zero" when its conductors are closed and "infinity" when they are open.
2. When a circuit or an element is subject to test pay attention to the grounding place, it should be free of paint, dirt, dust, etc.
3. When performing a test see that the contacts are secure.
4. It is prohibited to measure the circuits and individual elements for insulation resistance when the latter are energised.
5. If the insulation resistance is below the rated value make a separate check of insulation of the unit terminals having disconnected the cable from the unit, then of the unit terminals with which the unit under test is connected (the cable being disconnected) and of the cable itself.

Table No.1 shows the rated values of the insulation resistance.

Table No. 1

Unit and its code	Plate Nos	Terminal Nos	Permissible value of insulation resistance of the ship	Megger	Note
1	2	3	4	5	6
Various receivers of unit 4-73-2x)		Receiver cable conductor	60 megohms	500 V	
33 receivers connected to units 8 and 8A	13	Conductors 34 and 1	0.3 megohm	500 V	Disconnect the conductors of cables 133 and 135 from terminals 1 - 10 of plates 1,3,5, 7,13 in units 8 and 8A (terminal box)
33 receivers connected to units 8 and 8A	13	Conductors 34 and 1	0.3 megohm	500 V	Disconnect the conductors of cables 134 and 136 from terminals 1 - 10 of plates 7,9,11, 13 in units 8 and 8A (terminal box)

x) The insulation resistance of individual receivers should be measured only if the insulation resistance of the whole system of unit 4-73-2 or of various groups of receivers is below the rated value given in this Table.

1	2	3	4	5	6
Control panel (unit 4)	193	Conductors running from terminal 4 to subunits KM and TP	2 megohms	100 V	1. Set switch CHECK — OPERATION — CALIBRATION (КОНТРОЛЬ — РАБОТА — КАЛИБРОВКА) to position CALIBRATION (КАЛИБРОВКА) 2. Withdraw subunit УС1 and turn it through 90° 3. Disconnect the conductors from terminal 4 of plate 193 (subunit УС1), running to subunits TP and KM
Control panel (unit 4)	24	1, 2	10 megohms	500 V	Disconnect conductors 2, 4 of cable 149
Distribution board (unit 21)	9	4, 5	0.5	500 V	With the OFF — ON (ВЫКЛ — ВКЛ) switch set to ON (ВКЛ) and the toggle switch, to ПР-2
Same	9	6, 7	60	500 V	With the toggle switch (ref.No.48) set to ПР-1Б and ПР-1Д
Preamplifiers (units 8 and 8A)	18	On the cable conductor 34	2	500 V	Disconnect conductor 34 of cables 138, 140 from terminal 5 of plate 18.

(b) CHECKING SEQUENCE OF RECEIVER CONNECTION

Since the receiver cable conductors have different markings, there is no need to check the polarity of the receivers. It is quite sufficient to thoroughly check the connection of receiver cable conductors to the terminal blocks of the cable boxes.

Tinting of cable КВА-1 conductors in one base can be as follows:

Conductor 1: (a) coloured;
(b) white with figure marking;
(c) with coloured caprone thread.

Conductor 2: (a) white;
(b) with white caprone thread.

If both conductors are coloured polyvinyl-chloride tubes with figures 1 and 2 indicating conductor numbers are fitted on the conductor ends.

The first conductors of the cables should be connected:

to terminals 1, 2, 3 ..... 33 of cable box No.1;
to terminals 34, 35, 36 ..... 66 of cable box No.2;
to terminals 67, 68, 69 ..... 99 of cable box No.3;
to terminals 100, 101, 102 ..... 132 of cable box No.4.

It should be borne in mind that wrong polarity of connection of one receiver at least affects the accuracy of direction finding. When the markings do not correspond to the polarity, the change of conductor ends should be registered in the Service Log.

The sequence of the receiver connection is checked in the dock or at sea with the help of a sensitive galvanometer.

Note: The sensitivity of the galvanometer should be of the order of 10^{-6} degrees. The galvanometer should be of a centre-zero type.

When checking the sense of connection the minus lead of the galvanometer should be connected to terminal 7 of plate 13, the plus lead to the corresponding input terminals from 1 to 10 of plates 1, 3, 5, 7, 9, 11 and from 1 to 6 of plate 13 of the preamplifiers.

Tables 2 and 3 represent the receiver Nos and the corresponding Nos of the preamplifier (units 8 and 8A) input terminals.

Table No. 2

Nos of receivers	Corresponding plates and terminals of preamplifiers		Side	No. from bow
	Plates Nos	Terminals Nos		
1	2	3	4	5
1	1	1	Starboard	1
2		2	same	2
3		3	same	3
4		4	same	4
5		5	same	5
6		6	same	6
7		7	same	7
8		8	same	8
9		9	same	9
10		10	same	10
11	3	1	same	11
12		2	same	12
13		3	same	13
14		4	same	14
15		5	same	15
16		6	same	16
17		7	same	17
18		8	same	18
19		9	same	19
20		10	same	20
21	5	1	same	21
22		2	same	22
23		3	same	23
24		4	same	24
25		5	same	25
26		6	same	26
27		7	same	27
28		8	same	28
29		9	same	29
30		10	same	30
31	7	1	same	31
32		2	same	32

1	2	3	4	5
33		3	Starboard	33
34		4	same	34
35		5	same	35
36		6	same	36
37		7	same	37
38		8	same	38
39		9	same	39
40		10	same	40
41	9	1	same	41
42		2	same	42
43		3	same	43
44		4	same	44
45		5	same	45
46		6	same	46
47		7	same	47
48		8	same	48
49		9	same	49
50		10	same	50
51	11	1	same	51
52		2	same	52
53		3	same	53
54		4	same	54
55		5	same	55
56		6	same	56
57		7	same	57
58		8	same	58
59		9	same	59
60		10	same	60
61	13	1	same	61
62		2	same	62
63		3	same	63
64		4	same	64
65		5	same	65
66		6	same	66

Table No. 3

Receiver No.	Preamplifier respective plates and terminals		Side	No. from bow
	Plates Nos	Terminals Nos		
1	2	3	4	5
132	13	6	Port	1
131		5	same	2
130		4	same	3
129		3	same	4
128		2	same	5

1	2	3	4	5
127		1	Port	6
126	11	10	same	7
125		9	same	8
124		8	same	9
123		7	same	10
122		6	same	11
121		5	same	12
120		4	same	13
119		3	same	14
118		2	same	15
117		1	same	16
116	[illegible]	10	same	17
115		9	same	18
114		8	same	19
113		7	same	20
112		6	same	21
111		5	same	22
110		4	same	23
109		3	same	24
108		2	same	25
107		1	same	26
106	7	10	same	27
105		9	same	28
104		8	same	29
103		7	same	30
102		6	same	31
101		5	same	32
100		4	same	33
99		3	same	34
98		2	same	35
97		1	same	36
96	5	10	same	37
95		9	same	38
94		8	same	39
93		7	same	40
92		6	same	41
91		5	same	42
90		4	same	43
89		3	same	44
88		2	same	45
87		1	same	46
86	3	10	same	47
85		9	same	48
84		8	same	49
83		7	same	50
82		6	same	51
81		5	same	52

1	2	3	4	5
		A	Same	53
80		3	same	54
79		2	same	55
78		1	same	56
77		10	same	57
76	1	9	same	58
75		8	same	59
74		7	same	60
73		6	same	61
72		5	same	62
71		4	same	63
70		3	same	64
69		2	same	65
68		1	same	66
67				

Let us discuss an example showing the technique of checking the receivers.

Example: check receiver No.1 for correct connection.

To check connection of receiver No.1, apply the plus lead of the galvanometer to terminal 1 of preamplifier (unit 8) plate 1. Now take a special iron clamp from the set of spare parts and place it on the middle part of the first starboard receiver counting from the bow and then dismount it by a jerky motion; in doing this the galvanometer pointer should deflect from the zero position to one or the other side.

If the polarity is correct the galvanometer pointer will deflect for all the receivers to the same direction. If the polarity does not correspond to the colouring, change the receiver ends in the cable box in their places. If the galvanometer pointer deflects to the opposite direction, the receiver connection is wrong (change the cable ends in their places).

To find the terminal to which this receiver is connected, take the plus lead of the galvanometer to all other terminals (2, 3, 4, etc.) in succession placing each time the iron clamp on the receiver under check and dismounting the latter with a jerk. The terminal which causes deflection of the galvanometer pointer will be just that to which the receiver (1) conductor is connected.

Disconnect the cable conductor from this terminal and take it to terminal 1; then proceed to check the next receiver following the above technique.

Note: While checking the polarity make a simultaneous check of sequence of the receiver ordinal numbers connected in the base.

(c) CHECKING THE VALVES OF UNITS 8 AND 8A FOR NOISINESS

To check the valves which are employed in the direction finding channel with phase and maximum method, it is necessary to proceed as follows: set the mode of operation switch (position 11) in unit 21 to position ON (ВКЛ). Set the mode of operation switch (position 17) in subunit УС1 of unit 4 to position CHECK (КОНТРОЛЬ). Rotate the handwheel of the two-channel compensator of unit 4 until the pointer is aligned with divisions 0, 90, etc. on the relative bearing scale.

The pointer position will indicate on this scale the number of the brush of the two-channel compensator commutator, which at the given moment is on the monitoring bar.

The noise voltage will be applied to the CRT indicator of subunit УС1 from the corresponding stages of unit 8 and 8а amplifiers.

Microphonic and noisy valves should be replaced.

(d) CHECKING THE RECEIVERS WITH THE CORRESPONDING STAGES OF THE PREAMPLIFIERS

The receivers with the corresponding stages of the preamplifiers are checked with the help of a check projector, unit 2 noise generator and bearing deflection indicator (visually and aurally).

To check the receivers with the corresponding stages, it is necessary to do the following: set the mode of operation switch (position 11) in unit 21 to position ON (ВКЛ). Set the mode of operation switch (position 17) in subunit УС1 of unit 4 to position CHECK (КОНТРОЛЬ).

Set the switch (ref. No.40) installed in unit 21 to position ПР-2. Set the switch (ref.No.48) installed in unit 21 to position ПР-1Б or ПР-1Ш.

The inboard projector provides for a check of the receivers within the sector of 150°. The voltage applied to the projector should be kept constant all the time. Rotation of the handwheel will set the compensator pointer to the following divisions on the relative bearing scale 30 .... 35 .... 40, etc. which will correspond to the receiver number. In this case the bearing deflection indicator should display a straight trace. Provided the receiver or the bearing deflection indicator occur to be faulty no straight trace will be shown on the bearing deflection indicator.

Using check projector 1Ш check the spread of sensitivity of various receivers together with the corresponding stages of the preamplifiers in mode CHECK (КОНТРОЛЬ). The voltage of the output signal should not differ by more than 2 times.

(e) CHECKING COMMUTATOR OF UNIT 4 COMPENSATOR

Dismount the compensator lid, swing open the disc with the brushes. Wipe the commutator dry with the help of clean cloth. Using combination unit Ц-57 (from the set of spare parts) check the resistance between each two operating bars of the commutator. If the insulation is good, the resistance between each two operating bars in unit 4 should be within the limits of: (see Table below)

Table No. 4

Port channel bars	Starboard channel bars	Resistance, ohms
1, 2, 3 ..... 19, 20	66, 67 ..... 84, 85	2000 ± 10%
21, 22, 23 .... 36, 37	86, 87 ..... 101, 102	22,000 ± 10%
38, 39, 40 .... 49, 50	103, 104 ..... 113, 114	48,000 ± 10%
51, 52, 53 .... 64, 65	115, 116 ..... 129, 130	78,000 ± 10%

Usually the reason for bad insulation is the accumulation of fine metal dust rubbed by the brushes off the commutator between the commutator bars.

If any two commutator bars are found to be shorted clean the space between them using a special tool from the set of spare parts.

(f) CHECKING OF AMPLIFIER SUBUNIT

1. Calibrating Two-Channel Amplifier
(see Diagram ЛЖ2.732.050 Сх3)

Calibration is performed with the aid of a local oscillator employing valve 6Н2П.

The frequency generated by the oscillator corresponds to the midband frequency of the amplifier. The circuit makes provision for calibration of the amplifier in phase and amplification.

The oscillator is switched on by means of setting the CHECK - OPERATION - CALIBRATION (КОНТРОЛЬ - РАБОТА - КАЛИБРОВКА) switch to position CALIBRATION (КАЛИБРОВКА).

The relative phase shift between voltages of the channels is adjusted by means of the PHASE CALIBRATION (КАЛИБРОВКА ФАЗЫ) potentiometers (ref.No.262) set to position I and the BANDS I, II (ДИАПАЗОНЫ I, II) switch (ref. No.263), to position II.

Balancing of the gain of the summing and differential channels is effected by the AMPLIFICATION CALIBRATION (КАЛИБРОВКА УСИЛЕНИЯ) potentiometers (ref. Nos 327 and 356).

To calibrate the amplifier proceed as follows:

1. Switch on the equipment following instructions given in Subitems a - e, Item 2, Chapter I.

2. Set the AMPLIFICATION (УСИЛЕНИЕ) switch (ref.No.45) to position 11.

After this the screen of the cathode-ray tube usually displays an ellipse. Operate the PHASE CALIBRATION (КАЛИБРОВКА ФАЗЫ) slloted shafts (ref.Nos 262 and 263) until the ellipse becomes a straight trace and then with the help of the AMPLIFICATION ADJUSTMENT (РЕГУЛИРОВКА УСИЛЕНИЯ) slloted shaft set the trace at an angle of 45°, i.e. so that the trace should coincide with the dashed line marked on the tube scale.

2. Checking Superheterodyne and Audio Amplifiers

It is unnecessary to tune and adjust the audio and superheterodyne amplifiers on board the ship since they have been tuned and adjusted at the Manufacturing plant. The only thing to do is to check the condition of the valves and to replace them if defective.

(g) CHECKING CONTROL SUBUNIT AND BEARING DEFLECTION INDICATOR
(see Diagram ЛЖ2.076.000 Сх3)

1. Checking Amplifier Balance

To check the amplifier balance, it is necessary to turn the two-channel compensator so that there would be no target noise on the indicator. In this case amplification of the two-channel amplifier should be minimum. Depress the BALANCE (БАЛАНС) button on the front of the control panel. The check selsyn scale must be fixed.

If the check selsyn scale keeps on rotating stop it by turning potentiometer BALANCE (БАЛАНС).

2. Checking Balance of Phase-Sensitive Detector

Set the CHECK - OPERATION - CALIBRATION (КОНТРОЛЬ - РАБОТА - КАЛИБРОВКА) switch to CALIBRATION (КАЛИБРОВКА). When depressing the BALANCE (БАЛАНС) button the check selsyn scale should be fixed. If the check selsyn scale keeps on rotating it should be stopped by turning the potentiometer (ref.No.19).

3. Checking Rating of the Amplifier Output Stage

To check rating of the amplifier output stage, make use of the check projectors and the noise generator.

For checking set the switches of unit 21 to the following positions: the mode of operation switch, ref. No.11, to position ON (ВКЛ), switch, ref. No.40, to position ПР-2, switch, ref.No.48, to position ПР-1Б.

Set the stepped gain control of the two-channel amplifier ДКУ to position 6, potentiometer knob, ref. No.4, in unit 21 to such a position when the output voltage of the two-channel amplifier summing channel is 20 V. Rotate the compensator handwheel to take the bearing on the check projector; this done, switch on the automatic target tracking system АСЦ and check whether the target has been caught by presence of a vertical trace on the bearing deflection indicator УОП.

Since the target has been caught, rotate the handwheel at a speed of 1 revolution per 4 seconds. In this case the output voltage across amplifier terminals 6, 7 of plate 66 in the control panel subunit should be 130 V minimum.

4. Dynamic Test of Automatic Target Tracking System (АСЦ) Resetting

Switch on the automatic target tracking system АСЦ and notice the reading on the bearing scale which corresponds to accurate resetting.

Turn the compensator through 5° from its position and switch on the automatic target tracking system АСЦ.

After 2 - 3 swingings the drive should stop at the reset position.

Checking of resetting is carried out with a 5-degree deflection in either side. The optimal value of feedback is selected with the aid of the FEEDBACK (ОБР. СВЯЗЬ) potentiometer (on the control panel front).

5. Adjustment of Bearing Deflection Indicator

For adjustment of the cathode-ray tube the front of the bearing deflection indicator panel is fitted with four potentiometer knobs marked "⟷" and "↕", BRIGHTNESS (ЯРКОСТЬ) and FOCUSING (ФОКУСИРОВКА).

Vertical shift of the bright trace is performed by the potentiometer marked "94", horizontal shift, by potentiometer "96".

When replacing the cathode-ray tube, it is necessary to match vertical deflection of the beam with the vertical line on the bearing deflection indicator scale for which purpose apply voltage only to the vertical plates (switch on CALIBRATION, КАЛИБРОВКА, and withdraw the valve from the differential channel) and turn the tube base so that the line on the tube screen and the vertical index line would be aligned.

10. MAINTENANCE OF THE EQUIPMENT WHEN THE SUBMARINE IS DOCKED

(a) When docking the submarine its bow, where the acoustic base and check projectors are installed in the dome, should have an easy access to the receivers with the aim of checking and probable replacing.

(b) When painting the hull from the outside, see that the dome would not be painted.

(c) It is necessary to protect the dome and the receivers from strikes, scratches and dents.

(d) When performing repair jobs inside the ship see that the units would not be subjected to strikes, snaking and the unit-to-unit connection cables would not be damaged.

Remove moisture and dust from the casings of the units using for the purpose a dry clean cloth and then a cloth soaked in pure non-acid vaseline.

(e) It is desirable that the temperature inside the sonar room should be not below +10°C.

11. MAINTENANCE OF THE EQUIPMENT DURING CONSERVATION AND DECONSERVATION

Conservation of the Equipment

When slushing the equipment the crew of the ship must follow the instructions given below to avoid causing damage to the equipment:

1. Dismount the microphones and headphones.
2. Wipe the casings of the units and apply a thin layer of non-acid vaseline.
3. Clean and apply a thin layer of non-acid vaseline to the commutator of compensator subunit KM of unit 4 with a special thoroughness.
4. Periodically but at least once every six months check the units for condition of slushing applying fresh anticorrosive lubricant, if necessary.

Deconservation

When performing deconservation procedure, follow the instructions presented below:

1. Reinstall the microphones and headphones.
2. Thoroughly wipe all the parts coated with vaseline and especially the commutator using a dry clean cloth; this done, check all the units.

12. INSPECTION OF THE EQUIPMENT BEFORE GOING TO SEA FOR A LONG TIME

Before going to sea it is necessary to check the equipment in compliance with the items stated in the sections of Daily Maintenance, Weekly Maintenance and Monthly Maintenance.

Check operation of all the switches and volume control (all the switches in the units should operate without jamming and be reliably locked; the volume control should rotate smoothly, without being applied any force and should have a good contact in all positions).

13. COMPLEMENT OF SINGLE SET OF SPARES

The single set of spares should be replenished after each voyage.

Chapter IV

TYPICAL TROUBLES AND REMEDIES

This chapter deals with the typical troubles, their causes, methods of detection and elimination.

Nos	Trouble	Cause	Methods of detection	Remedy
1	2	3	4	5
	1. Preamplifiers (units 8 and 8A)			
1	When testing valves in succession for noisiness the noise voltage is not applied to the indicator of amplifier УС1 subunit	(a) Valve faulty	(a) With the aid of monitoring bar of two-channel compensator	(a) Replace valve
	2. Receivers			
2	When checking receivers in succession with the corresponding stages of preamplifiers noise is not heard	(a) Discontinuity of receiver circuit	(a) With the aid of monitoring bar of check projector two-channel compensator and noise generator	(a) Disconnect faulty receiver in terminal boxes of units 8 and 8A
	3. Control Panel			
3	(a) Compensator ball bearing (b) Amplifier Subunit УС1	Some bars of commutator shorted	Check commutator as instructed in Item 9e	Clean commutator and check insulation
4	1. Two-channel amplifier			
5	(a) At maximum amplification no image is seen on the cathode-ray tube screen of the bearing deflection indicator (interference)	(a) Amplifier supply circuit defective (b) Amplifier valves defective	Check amplifier valves and supply circuits	(a) Replace valves (b) Replace tube for a new one if supply circuit defective

1	2	3	4	5
		(c) Tube defective		(c) Replace tube as follows: (1) insert tube in the base; (2) disconnect differential channel; (3) set switch to CALIBRATION (КАЛИБРОВКА); (4) turn tube to match bright trace with vertical line on the screen, next secure tube
6	(b) With the switch set to CALIBRATION (КАЛИБРОВКА) no image is seen on the tube screen	Heterodyne valve defective	Check heterodyne valve	
7	(c) During calibration a vertical trace is displayed on the tube screen instead of an inclined one	One of valves in differential channel defective	Check valves	Replace defective valve
8	(d) During calibration a horizontal trace is displayed on the tube screen instead of an inclined one	One of valves in summing channel defective	Same	Same
	2. Superheterodyne and audio amplifiers			
9	At full amplification the noise is not heard in the headphones and loudspeakers but seen on the tube screen	One of valves in superheterodyne or audio amplifiers defective	Check valves	Replace valve
	4. Control Subunit			
10	Equipment fails to track target	(a) Fuse 110 V, 427 c/s blown	(a) Lamp MAINS is not lighted	(a) Replace fuse
		(b) Valve 6Н1П(5) defective	(b) Target indicator pointer is not deflected when bright trace is passing	(b) Replace valve for a new one

1	2	3	4	5
			vertical direction	
		(c) Germanium diode Д2К in rectifying bridge defective	(c) No anode voltage across jacks 50, 51	(c) Replace diode Д2К if defective
11	Drive rotates in one direction	Valve 6Н2П (ref. No.32) defective	Turn the FEED-BACK (ОБРАТНАЯ СВЯЗЬ) potentiometer counter-clockwise until it stops	Replace valve if defective
		Valve 6Н1П (ref.No.46) defective	Balance the amplifier with the aid of a meter. Balancing possible, valve 6Н1П is defective (ref.No.46). If not, valve 6Н2П (ref.No.32) is defective	
	5. Rectifier 20			
12	Rectified voltage below 17.1 V	Ageing of rectifier selenium piles	With the aid of a voltmeter	Solder conductor to the other tap (voltage should be within 17.1 - 20.7 V)
	6. Rectifier 20 A			
13	With the mains A.C. voltage rated, the rectified voltage across selenium rectifier is below 5.7 V	Ageing of rectifier selenium piles	With the aid of a voltmeter	Resolder conductor to the other tap (voltage should be within 5.7 - 6.9 V)
	7. Distribution Board			
14	Equipment operates normally but neon lamps are not lighted	Lamps burnt out or make poor contact with holders	Check lamps with combination unit Ц-57	Replace lamps for new ones if burnt out
15	When equipment is switched on fuses blow	Short circuit in equipment supply circuit	Check supply circuits	Remove fault and replace blown fuses

SECRET

Chapter V

REFERENCE TABLES

Table No. 5

ELECTRIC VACUUM DEVICES USED IN THE EQUIPMENT

GOST, Spec., Standard Drawing	Description	Service life, hours	Basing
1	2	3	4
TC3.301.000 TY1	6Н3П	500	1, 9 - heater 2 - first triode cathode 3 - first triode grid 4 - first triode anode 5 - screen 6 - second triode anode 7 - second triode grid 8 - second triode cathode
ЧТУ 07-302-52	8Л029	500	1, 14 - heater 2 - cathode 3 - modulator 4, 12 - vacant 5 - first anode 7, 8 - lower deflection plate 9 - second anode 10, 11 - upper deflection plate
ЧТУ 01-107-53	6П1П	500	1 - anode 2, 9 - second grid 3, 8 - cathode, screen 4, 5 - heater 6 - anode 7 - first grid
ЧТУ 10-312-56	ТГ3-0.1/1.3	50[illegible]	1 - grid 2 - cathode 3, 4 - heater 5, 7 - screen 6 - anode
ТС3.300.004 ТУ1	6Ж1П	5[illegible]	1 - first grid 2, 7 - cathode, third grid, screen 3, 4 - heater

1	2	3	4
			5 - anode 6 - second grid
ЧТУ 01-106-53	6Н2П	500	1 - first triode anode 2 - first triode grid 3 - first triode cathode 4, 5 - heater 6 - second triode anode 7 - second triode grid 8 - second triode cathode 9 - screen
ЧТУ 01-105-53	6Н1П	500	1 - first triode anode 2 - first triode grid 3 - first triode cathode 4, 5 - heater 6 - second triode anode 7 - second triode grid 8 - second triode cathode 9 - screen
ЧТУ 01-109-58	6Ц4П	500	1 - first diode anode 2 - vacant 3, 4 - heater 5 - cathode 6 - vacant 7 - second diode anode
ЧТУ 01-418-52	5Ц3С	500	1 - vacant 2, 8 - filament 4 - second diode anode 6 - first diode anode
ЧТУ 01-440-56	6Ж5П	500	1 - first grid 2 - beam-forming plates 3, 4 - heater 5 - anode 6 - second grid 7 - cathode
ЧТУ 01-508-52	2Ц2С	500	2, 7 - cathode (filament) 4, 5 - vacant top lead-out - cap-anode
GOST 9005-59	ТН-0.3	200	Base type P-10
ТУ No.1-3-108a	МН-16	100	Base type P-10/13-1
ТТЗ.362.006 ТУ	Д-204	5000	
ТТЗ.362.011 ВТУ	Д-211	5000	
ВТУ.06.690-56	Д2Ж	4000	

OPERATING CONDITIONS OF VALVES USED IN THE EQUIPMENT

Table No. 6

VALVE OPERATING CONDITIONS OF UNITS 8, 8A AND УС1

Valve type	6Ж5П	6Н2П	6Ж1П	6Ж5П	6Н2П	6Ж1П	6Ж2П	6Н2П	6Ж2П	6Н2П	6Н2П	6П1П	6Н2П	6Н3П
Diag. ref. No.	30	59	102	202	233	271	124	290	149	300	172	183	11	2
1	-	145	-	-	145	-	0	295	0	200	250	250	190	6.3
2	0	-	1.45	1.45	-	1.5	0.9	-	0.95	-	-	240	-	0.8
3	0	0.8	-6.3	0	0.9	-6.3	-6.3	0.6	-6.3	0.6	1.3	14	16	-
4	-6.3	-6.3	-6.3	-6.3	-6.3	-6.3	-6.3	-6.3	-6.3	-6.3	-6.3	-6.3	0	60
5	72	-6.3	110	72	-6.3	85	200	-6.3	200	-6.3	-6.3	-6.3	6.3	0
6	140	215	120	140	215	120	70	180	80	200	150	250	150	80
7	1.3	-	1.45	1.3	-	1.5	-	10	-	11	-	-	-	-
8		1.2			1.2			2		2		14	1	0.8
9		0			0			0		0	0	240	0	6.3

Note: Numbers from 1 to 9 denote valve pins

VALVE OPERATING CONDITIONS OF CONTROL SUBUNIT

Table No. 7

Diagram ref.No.	Valve type	Filament voltage, V	Anode voltage, V	Note
5	6Н1П	6.3 ± 10%	220 ± 15%	relative to body
32	6Н2П	6.3 ± 10%	50 ± 15%	relative to body
46	6Н1П	6.3 ± 10%	240 ± 10%	anode relative to cathode